Attachment 2

Laboratory Analysis for the

Four Hazardous Waste

Characteristics, Total Organic

Carbon, Phenolics and Oil & Grease

including QA/QC Reports

Attachment 2

Laboratory Analysis for the

Four Hazardous Waste

Characteristics, Total Organic

Carbon, Phenolics and Oil & Grease

including QA/QC Reports

DATE: 4-14-80

LAB NO. 1052
SAMPLE ID. _____

EP TOXICITY DATA WORKSHEET
RESOURCE ENGINEERING LABORATORY

1. SAMPLE APPEARANCE: Soil
2. SEPARATION PROCEDURE RESULTS: ___ < 0.5% Solids ___ ≥ 0.5% Solids
3. FRACTION TO BE TESTED: ___ Liquid ✓ Solid

NOTE: If liquid fraction is used, proceed directly to analysis—no extraction is required. Items 4-11 pertain to extraction of samples containing solids ≥ 0.5%.

4. SIZE REDUCTION REQUIRED: ✓ Yes ___ No
5. WEIGHT OF SAMPLE: 100.0g
6. WEIGHT OF DI WATER ADDED (16 x sample weight): 1600g/mls
7. TIME AGITATION BEGUN: 10:40 a.m.
8. FIRST pH MEASUREMENT (One minute after agitation is begun)
   - 5.95 a. Initial pH
   - 1.10 b. Amount of 0.5 N acetic acid added to obtain pH of 5.0 ± 0.2
   - 10:46 c. Time agitation restarted (a.m.)
9. SECOND pH MEASUREMENT (15 minutes after initial agitation)
   - 4.80 a. Initial pH
   - — b. Amount of 0.5 N acetic acid added to obtain pH of 5.0 ± 0.2
   - 10:55 c. Time agitation restarted (a.m.)
10. THIRD pH MEASUREMENT (30 minutes after initial agitation)
    - 5.0 a. Initial pH
    - 0.10 b. Amount of 0.5 N acetic acid added to obtain pH of 5.0 ± 0.2
    - 11:10 c. Time agitation restarted (a.m.)
11. FOURTH pH MEASUREMENT (60 minutes after initial agitation)
    - 4.7 a. Initial pH
    - — b. Amount of 0.5 N acetic acid added to ontain pH of 5.0 ± 0.2
    - 11:25 c. Time agitation restarted (a.m.)

NOTE: Continue to check pH at 60 minute intervals for first six hours and adjust as necessary to maintain pH at 5.0 ± 0.2. Record data for each check/adjustment interval on back of form noting initial pH, amount of acid added, and time agitation restarted. Do this until pH is stable or the maximum amount of acid allowed has been used. If at the end of the 24 hour extraction period the pH is above 5.2 and the maximum amount of acid (4 mls/g of sample) has not been used, adjust pH to 5.0 ± 0.2 and continue to extract for four hours, adjust the pH at one hour intervals.

At the end of the extraction period add deionized water to the extractor in the amount determined by the following equation:

$$V = 20(W) - 16(W) - A$$

Where: V = mls deionized water to be added
W = grams of sample (solids) used
A = mls of 0.5 N acetic acid added (total)

ANALYTICAL RESULTS OF TESTING LIQUID FRACTION (EXTRACT OR THE WASTE) ITSELF IF < 0.5% SOLIDS):

___ ARSENIC	___ ENDRIN
___ BARIUM	___ LINDANE
___ CADMIUM	___ METHOXYCHLOR
___ HEXAVALENT CHROMIUM	___ TOXAPHENE
___ LEAD	___ 2,4-D
___ MERCURY	___ 2,4,5-TP SILVEX
___ SELENIUM	

	TIME/HOUR	pH	0.5 N ACETIC ACID ADDED
2.	11:45	4.45	—
3.	13:00	4.90	0.10
4.	14:00	4.80	—
5.	15:00	4.80	—
6.	16:00	4.80	—
	9:10	5.10	—

5.10 FINAL pH

AFTER 24 HOURS ± .5 HOURS

DATE: 4/14/89

LAB NO. 5952 Dup
SAMPLE ID. _____

EP TOXICITY DATA WORKSHEET
RESOURCE ENGINEERING LABORATORY

1. SAMPLE APPEARANCE: Soil
2. SEPARATION PROCEDURE RESULTS: ____ < 0.5% Solids ____ ≥ 0.5% Solids
3. FRACTION TO BE TESTED: ____ Liquid ✓ Solid

NOTE: If liquid fraction is used, proceed directly to analysis--no extraction is required. Items 4-11 pertain to extraction of samples containing solids ≥ 0.5%.

4. SIZE REDUCTION REQUIRED: ____ Yes ____ No
5. WEIGHT OF SAMPLE: 100.0 g
6. WEIGHT OF DI WATER ADDED (16 x sample weight): 1600 g/mls
7. TIME AGITATION BEGUN: 10'40 a.m.
8. FIRST pH MEASUREMENT (One minute after agitation is begun)
   - 6.30 a. Initial pH
   - 0.40 b. Amount of 0.5 N acetic acid added to obtain pH of 5.0 ± 0.2
   - 10.42 c. Time agitation restarted (a.m.)
9. SECOND pH MEASUREMENT (15 minutes after initial agitation)
   - 4.80 a. Initial pH
   - ____ b. Amount of 0.5 N acetic acid added to obtain pH of 5.0 ± 0.2
   - 10:55 c. Time agitation restarted (a.m.)
10. THIRD pH MEASUREMENT (30 minutes after initial agitation)
    - 5.15 a. Initial pH
    - 0.10 b. Amount of 0.5 N acetic acid added to obtain pH of 5.0 ± 0.2
    - 11:10 c. Time agitation restarted (a.m.)
11. FOURTH pH MEASUREMENT (60 minutes after initial agitation)
    - 5.10 a. Initial pH
    - 0.10 b. Amount of 0.5 N acetic acid added to ontain pH of 5.0 ± 0.2
    - 11:25 c. Time agitation restarted (a.m.)

NOTE: Continue to check pH at 60 minute intervals for first six hours and adjust as necessary to maintain pH at 5.0 ± 0.2. Record data for each check/adjustment interval on back of form noting initial pH, amount of acid added, and time agitation restarted. Do this until pH is stable or the maximum amount of acid allowed has been used. If at the end of the 24 hour extraction period the pH is above 5.2 and the maximum amount of acid (4 mls/g of sample) has not been used, adjust pH to 5.0 ± 0.2 and continue to extract for four hours, adjust the pH at one hour intervals.

At the end of the extraction period add deionized water to the extractor in the amount determined by the following equation:

$$V = 20(W) - 16(W) - A$$

Where: V = mls deionized water to be added
W = grams of sample (solids) used
A = mls of 0.5 N acetic acid added (total)

ANALYTICAL RESULTS OF TESTING LIQUID FRACTION (EXTRACT OR THE WASTE) ITSELF IF < 0.5% SOLIDS):

____ ARSENIC	____ ENDRIN
____ BARIUM	____ LINDANE
____ CADMIUM	____ METHOXYCHLOR
____ HEXAVALENT CHROMIUM	____ TOXAPHENE
____ LEAD	____ 2,4-D
____ MERCURY	____ 2,4,5-TP SILVEX
____ SELENIUM	

	TIME/HOUR	pH	0.5 N ACETIC ACID ADDED
2.	11:45	4.95	0.10
3.	13:00	5.15	0.10
4.	14:00	5.0	0.10
5.	15:00	4.80	—
6.	16:00	4.80	—
	9:10	5.05	—

5.05 FINAL pH

AFTER 24 HOURS ± .5 HOURS

RESOURCE ENGINEERIN[illegible]BORATORIES
QUALITY CONTROL LOG

METHOD OF ANALYSIS 303A 15th Ed. PARAMETER Ag MATRIX Water

ANALYST KD DATE 4/29/86 TIME 9:45-10:15

CALIBRATION STANDARDS/BLANK	ABSORBANCE
Blank	0.000
0.1 ppm	0.003
0.3 ppm	0.011
1.0 ppm	0.039

STANDARDS	CONC.	STD. CONC.	PERCENT DEVIATION
Blank	<0.01		
0.1 ppm	0.097	0.1	3.0
0.3 ppm	0.302	0.3	0.7
1.0 ppm	1.004	1.0	0.4
EPA 283 #1	0.975	1.0	2.5

PROJECT #/LAB NUMBERS IN THIS RUN 7069, 7050

QUALITY CONTROL SPIKES

PERCENT RECOVERY CALCULATION: PERCENT (SAMPLE · CONC.) + (STANDARD · CONC.) = THEORETICAL CONC.

LAB #-SAMPLE ID #	CONC. ppm	REPLICATE CONC.	PERCENT DEVIATION	PERCENT (SAMPLE · CONC.)	PERCENT (STANDARD · CONC.)	STD. CONC.	THEORETICAL CONC.	SPIKE CONC.	THEO. CONC.	PERCENT RECOVERY
7050	<0.01	<0.01	0.00	50% (<0.01)	50% (1.0)	0.50		.499	.50	99.8
7069	<0.01	<0.01	0.00							

TIME 14:30 ANALYST Krishnaday

QC APPROVAL Joann. Hood

RESOURCE ENGINEERING LABORATORIES
QUALITY CONTROL LOG

METHOD OF ANALYSIS 303 E 15th Ed PARAMETER As in ppb MATRIX Water

ANALYST KD DATE 5/5/86 TIME 7:45 - 13:20

CALIBRATION STANDARDS/BLANK	ABSORBANCE
Blank	0.000
2.5 ppb	0.082
5.0 ppb	0.168
10.0 ppb	0.318

STANDARDS	CONC.	STD. CONC.	PERCENT DEVIATION
Blank	<1.0		
2.5 ppb	2.472	2.5	1.1
5.0 ppb	4.922	5.0	1.6
10.0 ppb	10.047	10.0	0.4
7.5 ppb (Int. std)	7.592	7.5	1.2

PROJECT #/LAB NUMBERS IN THIS RUN: 7062, 6977, 7079, 7026, 7050, 6987, 7065, 7020, 7069, 7068, 7029

QUALITY CONTROL SPIKES

PERCENT RECOVERY CALCULATION: PERCENT (SAMPLE • CONC.) + (STANDARD • CONC.) = THEORETICAL CONC. STD. CONC.

LAB #-SAMPLE ID #	CONC.	REPLICATE CONC.	PERCENT DEVIATION	PERCENT (SAMPLE • CONC.)	PERCENT (STANDARD • CONC.)	STD. CONC.	THEORETICAL CONC.	SPIKE CONC.	THEO. CONC.	PERCENT RECOVERY
6977 A5-03-C	<1.0	<1.0	0.00	50% (<1.0)	50% (10 ppb)	5.0		4.756	5.0	95.1
6987 B-1-5 (oil)	<1.0	<1.0	0.00	50% (<1.0)	50% (10 ppb)	5.0		1.430	5.0	28.6
6987 B-1-5 (H_2O)	<1.0			50% (<1.0)	50% (10 ppb)	5.0		4.477	5.0	95.5
7065 3A	<1.0	<1.0	0.00	50% (<1.0)	50% (10 ppb)	5.0		2.655	5.0	53.1
7065 4A	<1.0			50% (<1.0)	50% (10 ppb)	5.0		1.838	5.0	36.8
7065 13A	<1.0	<1.0	0.00							
7026 42B	1.513	1.385	8.5	50% (1.385)	50% (10 ppb)	5.693		3.840	5.693	67.5
7020 46B	<1.0	<1.0	0.00							
6977 A5-08-EMOA	4.309									
6987 B15-(H_2O)MOA	4.968									

TIME 15:35 ANALYST Kristin Hadley

QC APPROVAL Joann M. Hood

RESOURCE ENGINEERIN. LABORATORIES
QUALITY CONTROL LOG

METHOD OF ANALYSIS 303E 15th Ed. PARAMETER AS in ppb MATRIX Water

ANALYST KD DATE 5/5/86 TIME 7:45 - 13:30

CALIBRATION STANDARDS/BLANK	ABSORBANCE

STANDARDS	CONC.	STD. CONC.	PERCENT DEVIATION

PROJECT #/LAB NUMBERS

IN THIS RUN

QUALITY CONTROL SPIKES

PERCENT RECOVERY CALCULATION:
PERCENT (SAMPLE • CONC.)+(STANDARD • STD. CONC.) = THEORETICAL CONC. SPIKE ± THEO. CONC. = PERCENT RECOVERY

LAB #-SAMPLE ID #	CONC.	REPLICATE CONC.	PERCENT DEVIATION
5987 B15 oil MOA	7.834		

TIME 15:35 ANALYST Krishnaday

QC APPROVAL Joan M. Hasel

RESOURCE ENGINEERING LABORATORIES
QUALITY CONTROL LOG

METHOD OF ANALYSIS 303 C 15th Ed PARAMETER Ba MATRIX Water

ANALYST KD DATE 4/30/86 TIME 10:45 – 11:40

CALIBRATION STANDARDS/BLANK	ABSORBANCE
Blank	
2.5 ppm	
5.0 ppm	
10.0 ppm	

STANDARDS	CONC.	STD. CONC.	PERCENT DEVIATION
Blank	<0.1		
2.5 ppm	2.490	2.5	0.4
5.0 ppm	5.124	5.0	2.4
10.0 ppm	10.087	10.0	0.9
EPA 283 #1	40.948	40.0	2.3

PROJECT #/LAB NUMBERS 7050
IN THIS RUN 7069
7077

QUALITY CONTROL SPIKES

PERCENT RECOVERY CALCULATION: PERCENT (SAMPLE • CONC.) + (PERCENT STANDARD • STD. CONC.) = THEORETICAL SPIKE CONC. ÷ THEO. CONC. = PERCENT RECOVERY

LAB #-SAMPLE ID #	CONC. ppm	REPLICATE CONC.	PERCENT DEVIATION	PERCENT (SAMPLE • CONC.)	+ (PERCENT STANDARD • STD. CONC.)	= THEORETICAL SPIKE CONC.	÷ THEO. CONC.	= PERCENT RECOVERY
7050	<0.1	<0.1	0.00	50% (0.091)	50% (10 ppm)	5.046	5.119/5.046	101.5
7069	<0.1	<0.1	0.00					
7077	2.352	2.373	0.9					

TIME 11:15 ANALYST Kristina Day QC APPROVAL Joan M. Hall

RESOURCE ENGINEERIN[illegible] .BORATORIES
QUALITY CONTROL LOG

METHOD OF ANALYSIS 303 A 15th Ed · PARAMETER Cd MATRIX Water

ANALYST K.D DATE 4/29/86 TIME 9:10 - 9:45

CALIBRATION STANDARDS/BLANK	ABSORBANCE
Blank	0.000
0.1 ppm	0.008
0.3 ppm	0.024
1.0 ppm	0.081

STANDARDS	CONC.	STD. CONC.	PERCENT DEVIATION
Blank	<0.01		
0.1 ppm	0.100	0.1	0.0
0.3 ppm	0.295	0.3	1.7
1.0 ppm	1.000	1.0	0.0
EPA 283 #1	0.704	0.7	0.6

PROJECT #/LAB NUMBERS IN THIS RUN 7050, 7069

QUALITY CONTROL SPIKES

PERCENT RECOVERY CALCULATION: PERCENT (SAMPLE · CONC.) + (STANDARD · CONC.) = THEORETICAL CONC.

LAB #-SAMPLE ID #	CONC. ppm	REPLICATE CONC.	PERCENT DEVIATION	PERCENT (SAMPLE · CONC.)	PERCENT (STANDARD · CONC.)	STD. CONC.	THEORETICAL SPIKE CONC.	THEO. CONC.	PERCENT RECOVERY
7050	<0.01	<0.01	0.00	50 % (<0.01)	50 % (1.0 ppm)	0.5	.504	0.5	100.8
7069	<0.01	<0.01	0.00						

TIME 15:15 ANALYST Kris Smedley

QC APPROVAL Joann Hoese

RESOURCE ENGINEERING LABORATORIES
QUALITY CONTROL LOG

METHOD OF ANALYSIS 303A 15th Ed. PARAMETER Cr MATRIX Water

ANALYST KD DATE 4/30/86 TIME 10:00-10:40

CALIBRATION STANDARDS/BLANK	ABSORBANCE
Blank	0.000
0.3 ppm	0.007
0.5 ppm	0.013
1.0 ppm	0.021

STANDARDS	CONC.	STD. CONC.	PERCENT DEVIATION
Blank	<0.01		
0.3 ppm	0.290	0.3	3.3
0.5 ppm	0.492	0.5	1.6
1.0 ppm	0.997	1.0	0.3
EPA 283 #1	1.23	1.25	1.6

PROJECT #/LAB NUMBERS IN THIS RUN 7050
7069

QUALITY CONTROL SPIKES

PERCENT RECOVERY CALCULATION:

LAB #-SAMPLE ID #	CONC. ppm	REPLICATE CONC.	PERCENT DEVIATION	PERCENT (SAMPLE · CONC.)+	(PERCENT STANDARD · STD. CONC.) =	THEORETICAL CONC.	SPIKE CONC. ÷ THEO. CONC. =	PERCENT RECOVERY
7050	<0.01	<0.01	0.00	50% (<0.01)	50% (1.0 ppm)	0.5	0.487/0.5	97.4
7069	<0.01	<0.01	0.00					

TIME 10:40 ANALYST Kris Almasdeny QC APPROVAL [signature]

RESOURCE ENGINEERING LABORATORIES
QUALITY CONTROL LOG

METHOD OF ANALYSIS 303F 15th Ed PARAMETER Hg MATRIX Water

ANALYST KD DATE 4/24/86 TIME 7:45 - 11:00

CALIBRATION STANDARDS/BLANK	ABSORBANCE
Blank	0.000
2.5 ppb	0.032
5.0 ppb	0.064
10.0 ppb	0.135

STANDARDS	CONC.	STD. CONC.	PERCENT DEVIATION
Blank	<1.0		
2.5 ppb	2.508	2.5	0.3
5.0 ppb	4.901	5.0	1.9
10.0 ppb	10.170	10.0	1.7
7.5 ppb (Int.Std)	7.450	7.5	0.7

PROJECT #/LAB NUMBERS IN THIS RUN
6987
7050
6977

QUALITY CONTROL SPIKES

PERCENT RECOVERY CALCULATION:
PERCENT (SAMPLE • CONC.) + (STANDARD • CONC.) = THEORETICAL CONC. SPIKE ÷ THEO. CONC. = PERCENT RECOVERY

LAB #-SAMPLE ID #	CONC. ppb	REPLICATE CONC.	PERCENT DEVIATION	PERCENT (SAMPLE • CONC.)	+ (STANDARD • CONC.)	= THEORETICAL CONC.	SPIKE CONC.	÷ THEO. CONC.	= PERCENT RECOVERY
6977 A5-03-C	1.084	0.708							
6977 A6-C	<1.0	<1.0	0.00						
6977 A5-03-C	1.084			Sample (1.084)	+ 5.0 ppb	6.084	6.078/6.084		99.9
6977 A6-C	<1.0 (0.958)			Sample (0.958)	+ 5.0 ppb	5.958	6.063/5.958		101.8

TIME 13:15 ANALYST Kris Almaraz

QC APPROVAL

RESOURCE ENGINEERI.. LABORATORIES
QUALITY CONTROL LOG

METHOD OF ANALYSIS 303A 15th Ed PARAMETER Pb MATRIX Water

ANALYST KD DATE 4/20/86 TIME 8:45 -10:00

CALIBRATION STANDARDS/BLANK	ABSORBANCE
Blank	0.000
0.3 ppm	0.002
0.5 ppm	0.004
1.0 ppm	0.009

STANDARDS	CONC.	STD. CONC.	PERCENT DEVIATION
Blank	<0.01		
0.3 ppm	0.292	0.3	2.6
0.5 ppm	0.477	0.5	4.6
1.0 ppm	1.019	1.0	1.9
EPA 283 #1	2.096	2.0	4.5

PROJECT #/LAB NUMBERS IN THIS RUN: 7050, 7069, 7076

QUALITY CONTROL SPIKES

PERCENT RECOVERY CALCULATION: (PERCENT (SAMPLE • CONC.) + PERCENT (STANDARD • CONC.)) = THEORETICAL CONC. ; SPIKE CONC. / THEO. CONC. = PERCENT RECOVERY

LAB #-SAMPLE ID #	CONC. ppm	REPLICATE CONC.	PERCENT DEVIATION	PERCENT (SAMPLE • CONC.)	PERCENT (STANDARD • CONC.)	STD. CONC.	THEORETICAL CONC.	SPIKE CONC. / THEO. CONC.	PERCENT RECOVERY
7050	<0.01	<0.01	0.00						
7076	0.154	0.157	1.9						
7050	<0.01	<0.01		50 % (<0.01)	50 % (1.0)	0.5	0.448	.5	89.6
7076	0.308			50 % (0.308)	50 % (1.0)	0.654	.621	.654	95.0

TIME 13:10 ANALYST Kmishmarley QC APPROVAL Joann Hoeel

Test Code(s) SE

Method Borohydride Analysts SCB Date 5/5/86 Time 4 P.M.

Standards:	Blank	(ABS)	Act.	Theo.
#1	Blank	0.004	0	
#2	1 5ppb	0.185	5	
#3	10 ppb	0.340	10	
#4	20 ppb	0.620	20	
#5				

Matrix Modification

# of samples in set 5

Duplicate	#1	#2
7050-83618	0.4ppb	0.4
7074 83619	0.4ppb	0.5

Spike Samples	Original	Amount Added	Act.	Theo.	% Recov
83619	0.4	10.0	10.9	10.4	= 113.4%
83618	0.4	10.0	10.7	10.4	= 102.9%

RESOURCE ENGINEERING LABORATORIES
QUALITY CONTROL LOG

METHOD OF ANALYSIS Leco Furn. Ag. #9 Vol 2 PARAMETER TOC MATRIX SOIL

ANALYST M. Tipton DATE 4-30-86 TIME 01100

CALIBRATION STANDARDS/BLANK	ABSORBANCE
BLANK	0

STANDARDS	CONC.	STD. CONC.	PERCENT DEVIATION
EPA STD	25.6%	22.6%	11.7 %

PROJECT #/LAB NUMBERS 7050
IN THIS RUN

QUALITY CONTROL SPIKES

PERCENT RECOVERY CALCULATION:
PERCENT (SAMPLE • CONC.) + (STANDARD • STD. CONC.) = THEORETICAL SPIKE CONC. ÷ THEO. CONC. = PERCENT RECOVERY

LAB #-SAMPLE ID #	CONC.	REPLICATE CONC.	PERCENT DEVIATION	PERCENT		PERCENT				
7050 -5I	0.12%	0.13%	7.7 %							

TIME _____ ANALYST MT

QC APPROVAL B. Blankfield

RESOURCE ENGINEER LABORATORIES
QUALITY CONTROL LOG

METHOD OF ANALYSIS 503-D STD METH 16th Add PARAMETER Oil & Grease MATRIX Soil

ANALYST Jeffrey A. Barber DATE 4/23/86 TIME 11:35 A.M.

CALIBRATION STANDARDS/BLANK	WT./G.
BLANK	0.0006

STANDARDS	CONC.	STD. CONC.	PERCENT DEVIATION

PROJECT #/LAB NUMBERS IN THIS RUN 7050

QUALITY CONTROL SPIKES

LAB #-SAMPLE ID #	CONC.	REPLICATE CONC.	PERCENT DEVIATION	SAMPLE RESIDUE IN GRAMS	SPIKE WEIGHT IN GRAMS	THEORETICAL WT.	ACTUAL WEIGHT	PERCENT RECOVERY
7050	1,063 mg/kg	962 mg/kg	9.5%					
7050	1,063 mg/kg	—	—	0.0021 (gm)	0.2761 (gm)	0.2782	0.2655	96.5%

TIME ______ ANALYST J. B.

QC APPROVAL James M. [illegible]

M.B.A. LABS

MICROBIOLOGICAL AND BIOCHEMICAL ASSAY LABORATORIES

P.O. BOX 9461 340 S. 66th STREET HOUSTON, TEXAS 77261
TELEPHONE NO. (713) 928-2701

SAMPLE SUBMITTED BY:	Resource Engineering
DATE RECEIVED:	4-11-86
DATE COMPLETED:	4-24-86
LABORATORY REPORT NUMBER:	J-2506
SAMPLE IDENTIFICATION:	Soil Sample Project # 306-02 Lab # 7050

RESULTS

Total Available H_2S	< 1 mg/kg

Note* QA/QC data is on sample J-2523

REPORTED BY: Joe Kress

M.B.A. LABS

MICROBIOLOGICAL AND BIOCHEMICAL ASSAY LABORATORIES

P.O. BOX 9461 340 S. 66th STREET HOUSTON, TEXAS 77261
TELEPHONE NO. (713) 928-2701

SAMPLE SUBMITTED BY:	Resource Engineering
DATE RECEIVED:	4-14-86
DATE COMPLETED:	4-17-86
LABORATORY REPORT NUMBER:	J-2523
SAMPLE IDENTIFICATION:	Two Soil Samples Project # 306-02 SI-2B and Polks Tank Project # 347-01

RESULTS

Polks Tank	
pH	6.0
Total Cyanide (available)	< 0.1 mg/kg
Total Available H_2S	< 1 mg/kg
SI-2B	
Total Cyanide (available)	< 0.1 mg/kg

REPORTED BY: Joe Kreal

REACTIVITY (TOTAL AVAILABLE H_2S)

ANALYST: Joe Kresse

TIME: Start 8:30 a.m.

DATE: 4-15-86

QA/QC DATA

Norm. of Thiosulfate = .025N (Checked against std. Dichromate)
Norm. Iodine = 0.025N

SULFIDE STD. 4-15-86, 8:30 a.m. Joe Kresse

5 mls. of 680 ppm H_2S in 100 mls. of 0.025N NaOH was titrated with Standard Iodine and Thiosulfate

mls of Iodine = 10.0
mls of Thiosulfate = 2.50

$$\text{mg/l Sulfide} = \frac{(10 - 2.0)\ 400}{5} = 600 \text{ mg/l}$$

RECOVERY 4-15-86, 8:30 a.m., Joe Kresse

5 mls of 600 mg/l H_2S was added to reaction flask and purged for 30 minutes at 60 mls/min Volume of Absorption Solution = 100 mls of 0.25N NaOH.

mls of Iodine = 10.0
mls of Thiosulfate = 3.10

$$\text{mg/l of Sulfide} = \frac{(10 - 3.10)\ 400}{5} = 552 \text{ mg/l}$$

$$\% \text{ Recovery} = \frac{552}{600} \times 100 = 92\% \text{ recovery}$$

Joe Kresse

SAMPLE RESULTS

SI-20

Sample J- 2506, Resource Lab #7050, 4-15-86, 9:10 a.m, Joe Kresse

Sample weight - 10 grams
Purge flow - 30 mins at 60 mls/min
Absorbent - 100 mls of 0.25 N NaOH
Titration
mls of Iodine = 10.00
mls of Thiosulfate = 10.00

mg/l Sulfide = ( ) 400 = mg/l

sp RT of Release = $\frac{\text{mg/l X 0.100}}{1800 \text{ X } (.010)}$ =

Total Available H_2S = . X 1800 =<1 mg/kg

Sample J- 2523 Polks Tank, SI-2B, 4-15-86, 9:10 a.m., Joe Kresse

Sample weight - 10 grams
Purge flow - 30 mins at 60 mls/min
Absorbent - 100 mls of 0.25N NaOH
Titration
mls of Iodine = 10.00
mls of Thiosulfate = 10.00

mg/l Sulfide = ( ) 400 = mg/l

sp RT of Release = $\frac{\text{mg/l X 0.100}}{1800 \text{ X } (.010)}$ =

Total Available H_2S = . X 1800 =<1 mg/kg

Sample J-

Sample weight - grams
Purge flow - 30 mins at 60 mls/min
Absrobent - 100 mls of 0.25N NaOH
Titration
mls of Iodine =
mls of Thiosulfate =

mg/l Sulfide = ( ) 400 = mg/l

sp RT of Release = $\frac{\text{mg/l X 0.100}}{1800 \text{ X } (.010)}$ =

Total Available H_2S . X 1800 = mg/kg

QA/QC TOTAL CYANIDE

4-16-86, 9;00 a.m. to 2:00 p.m., Joe Kresse

Method: Barbituric Acid, Absorbance at 578 nms

Standards used (Not distilled)	Absorbance at 578
Blk	0
20 ug/l	0.040
40 ug/l	0.078
100 ug/l	0.204
200 ug/l	0.406
300 ug/l	0.601
400 ug/l	0.810

Sample J-2523 Sample SI-2B — 0.000

10 gms → 250 ml = — <0.1 mg/kg

Distilled Standard (100 ug/l) — .188

Recovered 92 ug/l

% Recovery = $\frac{92}{100}$ X 100 = 92%

Sample J-2523 Polks Tanke — 0.001

10 gm → 250 ml = — <0.1 mg/kg

RESOURCE ENGINEERING LABORATORIES
QUALITY CONTROL LOG

METHOD OF ANALYSIS Std. Meth. 14Ed. 510 A & C PARAMETER Phenol MATRIX Soil / D.I H_2O

ANALYST D. Maupin DATE 5-19-84 TIME 0900

CALIBRATION STANDARDS/BLANK	ABSORBANCE
BLK	0.00
1.00	0.143
3.00	0.431

STANDARDS	CONC.	STD. CONC.	PERCENT DEVIATION
1.00	0.993		0.70%
3.00	3.028		0.93%
0.200	0.207		~~0.97%~~ 3.50%

PROJECT #/LAB NUMBERS 5066 (1-1 — 7 / -> 6), (2-1 -> 2-5), (3-1 3-1B 3-2), (4-1 4-2A 4-2B)
IN THIS RUN

QUALITY CONTROL SPIKES

PERCENT RECOVERY CALCULATION: PERCENT (SAMPLE • CONC.) + (PERCENT STANDARD • STD. CONC.) = THEORETICAL CONC.

LAB #-SAMPLE ID #	CONC.	REPLICATE CONC.	PERCENT DEVIATION	PERCENT (SAMPLE • CONC.)	PERCENT STANDARD	STD. CONC.	THEORETICAL CONC.	SPIKE ± THEO. CONC.	PERCENT RECOVERY
5066 1-4	<0.12	<0.12	-0-	80 • <0.12	20	1.0	0.200	0.204	102.0%
5066 3-2	<0.12	<0.12	-0-	80 • <0.12	40	1.0	0.400	0.395	98.8%

TIME _____ ANALYST _____

QC APPROVAL B. Blaylock

Attachment 3

Subsurface Exploration Record

Soil Borings 1-4

RESOURCE ENGINEERING INCORPORATED

SUBSURFACE EXPLORATION RECORD

Client: Lufkin Creosote
Boring #: 4
Architect Engineer:
Job #: 306-01
Project Name:
Drawn By: TJ
Project Location:
Approved By: KD

DRILLING and SAMPLING INFORMATION

Date Started: 6/14/84 — Hammer Wt.: 140 lbs.
Date Completed: 6/14/84 — Hammer Drop: 30 in.
Drill Foreman: TY — Spoon Sampler OD: 2.0 in.
Inspector: JB — Rock Core Dia.: - in.
Boring Method: HSA — Shelby Tube OD: 3.0 in.

TEST DATA

SOIL CLASSIFICATION / SURFACE ELEVATION –	Stratum Depth	DEPTH SCALE	SAMPLE NO.	SAMPLE TYPE	% RECOVERY	GROUND WATER	Standard Penetration Test N, Blows/Ft.	Unconfined Compressive Strength q_u Tons/Ft.²	Pocket Penetrometer * q_p Tons/Ft.²	Permeability X 10^{-} cm/sec.	Natural Dry Density lbs./cu. ft.	Water Content %	LL = Liquid Limit PL = Plastic Limit SL = Shrinkage Limit
FILL MATERIAL													
POND INTERFACE @ 5.5'		5	1	SS	11		3						
CLAYEY SILTY SAND (ML)			2	SS	89		2 1/2						
Boring terminated @ 6.5'													

SAMPLER TYPE
SS – DRIVEN SPLIT SPOON
ST – PRESSED SHELBY TUBE
CA – CONTINUOUS FLIGHT AUGER
RC – ROCK CORE

GROUND WATER DEPTH
▽ AT COMPLETION FT.
▼ AFTER HRS. FT.
WATER ON RODS FT.

BORING METHOD
HSA – HOLLOW STEM AUGERS
CFA – CONTINUOUS FLIGHT AUGERS
DC – DRIVING CASING
MD – MUD DRILLING

RESOURCE ENGINEERING INCORPORATED

SUBSURFACE EXPLORATION RECORD

Client: Lufkin Creosote
Architect Engineer:
Project Name:
Project Location:

Boring # 3
Job # 306-01
Drawn By TJ
Approved By KD

DRILLING and SAMPLING INFORMATION

Date Started 6/14/84 Hammer Wt. 140 lbs.
Date Completed 6/14/84 Hammer Drop 30 in.
Drill Foreman TY Spoon Sampler OD 2.0 in.
Inspector JB Rock Core Dia. - in.
Boring Method HSA Shelby Tube OD 3.0 in.

SOIL CLASSIFICATION / SURFACE ELEVATION –	Stratum Depth	DEPTH SCALE	SAMPLE NO.	SAMPLE TYPE	% RECOVERY	GROUND WATER	Standard Penetration Test N, Blows/Ft.	Unconfined Compressive Strength q_u Tons/Ft.² * Pocket Penetrometer q_p Tons/Ft.²	Permeability X 10⁻ cm/sec.	Natural Dry Density lbs./cu. ft.	Water Content %	LL = Liquid Limit PL = Plastic Limit SL = Shrinkage Limit
FILL MATERIAL (Over Old Pit)												
			1	SS								
INTERFACE												
SILTY CLAY, light gray-olive(CL)		5	2	SS								
Boring terminated @ 5.5'												

SAMPLER TYPE
SS – DRIVEN SPLIT SPOON
ST – PRESSED SHELBY TUBE
CA – CONTINUOUS FLIGHT AUGER

GROUND WATER DEPTH
▽ AT COMPLETION FT.
▼ AFTER HRS. FT.

BORING METHOD
HSA – HOLLOW STEM AUGERS
CFA – CONTINUOUS FLIGHT AUGERS
DC – DRIVING CASING

RESOURCE ENGINEERING INCORPORATED

SUBSURFACE EXPLORATION RECORD

Client: Lufkin Creosote
Architect Engineer:
Project Name:
Project Location:

Boring # 2
Job # 306-01
Drawn By TJ
Approved By KD

DRILLING and SAMPLING INFORMATION

Date Started 6/14/84 Hammer Wt. 140 lbs.
Date Completed 6/14/84 Hammer Drop 30 in.
Drill Foreman TY Spoon Sampler OD 2.0 in.
Inspector JB Rock Core Dia. - in.
Boring Method HSA Shelby Tube OD 3.0 in.

TEST DATA

SOIL CLASSIFICATION / SURFACE ELEVATION –	Stratum Depth	DEPTH SCALE	SAMPLE NO	SAMPLE TYPE	% RECOVERY	GROUND WATER	Standard Penetration Test N, Blows/Ft.	Unconfined Compressive Strength q_u Tons/Ft.² Pocket Penetrometer * q_p Tons/Ft.²	Permeability X 10^{-} cm/sec.	Natural Dry Density lbs./cu. ft.	Water Content %	LL = Liquid Limit PL = Plastic Limit SL = Shrinkage Limit
SILTY SAND FILL, gray-brown			1	ST	75							
roots @ 3'			2	ST	75							
clay balls and wet @ 6'		5	3	ST	75							
			4	ST	88							
CLAYEY SILTY SAND, gray-brown, thin clay lens @ 7.8' (ML)			5	ST	88							
Boring terminated @ 9.5'												

SAMPLER TYPE
SS – DRIVEN SPLIT SPOON
ST – PRESSED SHELBY TUBE
CA – CONTINUOUS FLIGHT AUGER

GROUND WATER DEPTH
▽ AT COMPLETION FT.
▼ AFTER HRS. FT.

BORING METHOD
HSA – HOLLOW STEM AUGERS
CFA – CONTINUOUS FLIGHT AUGERS
DC – DRIVING CASING

RESOURCE ENGINEERING INCORPORATED

SUBSURFACE EXPLORATION RECORD

Client: Lufkin Creosote
Architect Engineer:
Project Name:
Project Location:

Boring # 1
Job # 306-01
Drawn By TJ
Approved By KD

DRILLING and SAMPLING INFORMATION

Date Started 6/14/84 Hammer Wt. 140 lbs.
Date Completed 6/14/84 Hammer Drop 30 in.
Drill Foreman TY Spoon Sampler OD 2.0 in.
Inspector JB Rock Core Dia. - in.
Boring Method HSA Shelby Tube OD 3.0 in.

SOIL CLASSIFICATION / SURFACE ELEVATION –	Stratum Depth	DEPTH SCALE	SAMPLE NO.	SAMPLE TYPE	% RECOVERY	GROUND WATER	Standard Penetration Test N, Blows/Ft.	Unconfined Compressive Strength q_u Tons/Ft.² Pocket Penetrometer * q_p Tons/Ft.²	Permeability X 10⁻ cm/sec.	Natural Dry Density lbs./cu. ft.	Water Content %	LL = Liquid Limit PL = Plastic Limit SL = Shrinkage Limit
SANDY SILT FILL, gray (ML)			1	CA								
SILTY S. CLAYEY SAND, loose, gray, thin clay layers (ML)			2	ST	83			1.7*				
		5	3	SS	67		4					
SILTY SAND, COMPACT, brown-gray, thin clay layers, wet @ 6' (ML)			4	ST								
			5	SS	39		19					
		10										
SANDY CLAYEY SILT, gray-olive, dry (ML)		15	6	ST	75							
Boring Terminated @ 15'												

SAMPLER TYPE
SS – DRIVEN SPLIT SPOON
ST – PRESSED SHELBY TUBE
CA – CONTINUOUS FLIGHT AUGER

GROUND WATER DEPTH
▽ AT COMPLETION FT.
▼ AFTER HRS. FT.

BORING METHOD
HSA – HOLLOW STEM AUGERS
CFA – CONTINUOUS FLIGHT AUGERS
DC – DRIVING CASING

Attachment 4

Texas Department of Water Resources

Technical Guidance Document #1

TOPIC: WASTE EVALUATION/CLASSIFICATION

Purpose:

The purpose of this guideline is to describe the classification system defined by the Rules of the Texas Department of Water Resources (TDWR) in Chapter 335 of the Texas Administrative Code. This classification system is based on the potential adverse impact that certain types or classes of industrial solid waste may have on human health or the environment.

Definitions:

Below are several definitions which are the basis for the waste classification system.

1. Class I Wastes - any industrial solid waste or mixture of industrial solid wastes which because of its concentration, or physical or chemical characteristics, is toxic, corrosive, flammable, a strong sensitizer or irritant, a generator of sudden pressure by decomposition, heat, or other means, and may pose a substantial present or potential danger to human health or the environment when improperly processed, stored, transported, or disposed of or otherwise managed, including hazardous industrial waste.

2. Class II Wastes - any individual solid waste or combination of industrial solid waste which cannot be described as Class I or Class III.

3. Class III Wastes - inert and essentially insoluble industrial solid waste, including materials such as rock, brick, glass, dirt, and certain plastics and rubber, etc., that are not readily decomposable.

4. Essentially Insoluble - any material which, if representatively sampled and placed in static or dynamic contact with deionized water at ambient temperature for seven days, will not leach any quantity of any constituent of the material into the water in excess of current United States Public Health Service or United States Environmental Protection Agency limits for drinking water as published in the Federal Register.

5. Hazardous Industrial Waste - any industrial solid waste or combination of industrial solid wastes identified or listed as a hazardous waste by the Administrator of the United States Environmental Protection Agency pursuant to Section 3001 of the Resource Conservation and Recovery Act of 1976. The Administrator has identified the characteristics of hazardous wastes and listed certain wastes as hazardous in Title 40 of the Code of Federal Regulations, Part 261, Subparts C and D, respectively.

Classification:

Waste classification is based upon information supplied by the waste generator. In most cases the initial classification of a waste material will be based upon readily available information and a conservative comparison with the definition of each class of wastes. The waste generator may submit detailed waste descriptions for the purpose of classification or a review of the classification of the waste.

Pursuant to TDWR Rules, it is the responsibility of the generator of a solid waste to determine if the waste is hazardous. Hazardous waste criteria may be found in Title 40 of the Code of Federal Regulations, Part 261, Subpart C. Any industrial solid waste which meets one of the four hazardous criteria is a hazardous waste. Wastes which are listed in Subpart D of the above referenced regulation are also hazardous wastes.

Class I wastes include all hazardous wastes as defined above, as well as materials which are toxic or carcinogenic, mutagenic, teratogenic, bioaccumulative, or persistent. Data about these characteristics may be found in published literature or determined experimentally. For the purpose of this classification scheme, a waste is considered toxic when the oral LD_{50} of the material tested on a rat is less than 500 mg/kg, when the inhalation LC_{50} of the material tested on a rat is less than 2 mg/l, or when the dermal LD_{50} of the material tested on a rabbit is less than 200 mg/kg. (LD_{50} is a statistically calculated dose of a material necessary to cause the death of 50% of an entire test animal population and is usually expressed in terms of milligrams of chemical per kilogram of animal).

Class II wastes are materials which do not have the properties of Class I or Class III wastes. These wastes may have properties such as combustibility, biodegradability, and/or solubility in water. A Class II waste might leach constituents in excess of the limits for drinking water when in contact with deionized water.

Class III wastes are inert and essentially insoluble materials. These wastes, when observed in a leachate test, do not leach any constituent in excess of the limits for drinking water.

Tests Used for Waste Evaluation:

Ignitability - See 40 CFR 261.
Corrosivity - See 40 CFR 261.
Reactivity - See 40 CFR 261.

EP Toxicity - See 40 CFR 261
This leachate test is one criteria used to distinguish between Class I and Class II.

Distilled Water Leachate Test - (See below)
This leachate test is one criteria used to distinguish between Class II and Class III.

Distilled Water Leachate Test

A. For a dry solid waste, i.e., a waste material without any free liquid associated with it:

1. Place a 250 gm. (dry weight) representative sample of the waste material in a 1500 ml. Erlenmeyer flask.*

2. Add one liter of deionized or distilled water to the flask and mechanically stir the material at a low speed for five (5) minutes.

3. Stopper the flask and allow to stand for seven (7) days.

4. Filter the supernatant solution through a .45 micron filter.

5. The filtered leachate should be subjected to a quantitative analysis for those component or ionic species identified in the analysis of the waste itself.

*NOTE: Quadruplicate samples of the waste should be leached and all results reported.

B. For wastes with free liquids, the liquid portion of the waste should be considered to be the leachate in step 5 above.

C. For sludge and slurries and other waste material containing particulate matter, the waste should be subjected to a separation procedure (i.e., filtration, centrifugation) sufficient to separate the liquid portion from the solids. The solids should then be leached as in A above, and data on both the liquid portion and the leachate should be submitted.

Reclassification Procedure:

A written request for waste reclassification may be made by the generator at any time. All information applicable to the waste being considered for reclassification should be submitted. The attached form may be used as a guide to reclassification. The nature of the waste and its initial classification determine which of the items listed below will be required for reclassification.

1. A description of the process or processes from which the waste is generated.

2. A quantitative analysis for the constituents which could reasonably be expected to be present in the waste due to the process or processes from which the waste was generated.

3. A quantitative analysis of the liquid fraction of the waste or of a leachate from the waste. Quadruplicate leachate tests shall be performed and all data reported.

4. Ignitability of the waste and/or the liquid fraction of the waste and/or the leachate of the waste.

5. Corrosivity of the waste and/or the liquid fraction of the waste and/or the leachate of the waste.

6. Reactivity of the waste.

7. Toxicity information about the waste. (This does not necessarily mean that experimental tests must be run). Reference source.

8. Carcinogenicity, mutagenicity, and/or teratogenicity of the material or any substance in the material. Reference source. When experimental tests are performed to determine if the waste is carcinogenic, mutagenic, or teratogenic, include a full description of the test.

9. Results from a determination as to whether the material or substance in the material is bioaccumulative or persistent.

10. Information pertaining to sampling procedures used including sample preservation and handling methods.

Attachment 5

Bioaccumulation, Biodegradation, and

Persistance Data for:

Naphthalene

Taken from:
EPA Document 440/4-85-020
October 1982
An Exposure and Risk Assessment
for Benzo(a)pyrene and Other
Polycyclic Aromatic Hydrocarbons
Volume II

TABLE 3-11. BIOACCUMULATION OF NAPHTHALENE IN TWO FISH SPECIES[a]

Species	NAPHTHALENE ACCUMULATION							
	Weeks Of Exposure							
	2		3		5		6	
	BCF	mg/kg dry tissue	BCF	mg/kg dry tissue	BCF	mg/kg dry tissue	BCF	mg/kg dry tissue
Coho Salmon[b] (Oncorhynchus kisutch)	20	0.07 ± 0.03	50	0.14 ± 0.07	80	0.24 ± 0.06	40	0.12±0.06

	Weeks Of Exposure				Weeks Of Depuration			
	1		2		1		2	
	BCF	mg/kg dry tissue	BCF	mg/kg dry tissue	BCF	mg/kg dry tissue	BCF	mg/kg dry tissue
Starry Flounder (P. stellatus)	700	2.1 ± 1.5	240	0.72 ± 0.30	100	0.30 ± 0.02	270	0.80 ± 0.04

a) Flow-through exposure to 0.003 ± 0.002 mg/l.

b) Note that after 6 weeks of exposure and 1 week of depuration, no naphthalene was detected.

Source: Roubal et al. (1978)

TABLE 3-12. BACTERIAL BIODEGRADATION PRODUCTS REPORTED FOR NAPHTHALENE

Degradation Product	Reference
1-naphthol; 4-hydroxyl-1-tetralone; trans-1,2-dihydroxyl-1,2-dihydro-naphthalene; 2-naphthol; 1,2- and 1,4-naphthoquinone	Cerniglia *et al.* (1979)
cis-dihydrodiols	Cerniglia *et al.* (1979)
1,2-dihydroxynaphthalene, salicyl-aldehyde, salicylate, catechol	Colwell and Sayler (1978)

TABLE 3-13. BIODEGRADATION RATES OF NAPHTHALENE

Test Type/Population Origin	Compound Tested	Results	Source
$^{14}CO_2$ evolution from stream sediment populations from petroleum contaminated area	^{14}C-naphthalene	90% of total PAH transformed at 40 hours; rate = 0.14 hr	Schwall and Herbes (1978)
Warburg O_2 consumption, non-acclimated sludge population	Naphthalene	33-64% of TOD[a] transformed	Malaney et al. (1967)
Shake flask freshwater sediment population	Hydrocarbon mixture (parraffines, mono- and dicyclic hydrocarbons)	Naphthalene: 3-12% decrease together with dodecane: 25-35% decrease (1% sterile hydrocarbon; 28 days)	Walker and Colwell (1975)
$^{14}CO_2$ evolution with seawater population from treated area	Naphthalene	0.4 µg/l/day (by day 3)	Lee et al, (1978)

[a]Theoretical Oxygen Demand

TABLE 3-20. THE PERSISTENCE OF NAPHTHALENE IN VARIOUS GENERALIZED AQUATIC SYSTEMS AFTER CESSATION OF LOADING AT 0.2 kg/hour[a]

System	Time Period (days)	% Lost from Water	% Lost from Sediment	% Lost from Total System
Pond	12	90.85	13.55	28.59
Eutrophic Lake	0.5	62.53	0.70	54.13
Oligotrophic Lake	12	56.94	7.17	56.04
River	0.5	99.98	2.51	78.59
Turbid River	0.5	99.98	3.71	86.76
Coastal Plain River	0.5	92.93	1.34	51.30

[a]All data simulated by the EXAMS (U.S. EPA-SERL, Athens, Ga.) model. [See text for further information about input parameters and Smith et al. (1978) for a description of the model.]

Attachment 6

Bioaccumulation, Biodegradation, and

Persistance Data for:

Anthracene, Acenaphthene, Fluoranthene,

Fluourene, Phenanthrene and Pyrene

Taken from:

EPA Document 440/4-85-020
October 1982
An Exposure and Risk Assessment
for Benzo(a)pyrene and Other
Polycyclic Aromatic Hydrocarbons
Volume III

TABLE 4-15. HALF-LIVES AND QUANTUM YIELDS FOR PHOTOLYSIS OF THE ANTHRACENE GROUP PAHs

Compound	Disappearance Quantum Yield	Photolysis Half-Life (hours)
Anthracene	0.003 (at 366 nm)	0.75
Phenanthrene	0.010 (at 313 nm)	8.4
Pyrene	0.002 (at 313 nm)	0.68
	0.0022 (at 366 nm)	0.68
Fluoranthrene	0.00120 (at 313 nm)	21
	0.2×10^{-6} (at 366 nm)	

Source: Zepp and Schlotzhauer (1979)

TABLE 4-16. BIOACCUMULATION DATA FOR ANTHRACENE

Organism	Compound	Exposure Time (hr)	BCF[a]	Reference
Cladoceran *Daphnia magna*	Anthracene	1	200	Herbes (197
Cladoceran *Daphnia pulex*	Anthracene	24	760	Herbes and Risi (1978)
Mayfly *Hexagenia* sp.	Anthracene	28	3500	Herbes (197

a) BCF = Bioconcentration factor.

TABLE 4-17. BIODEGRADATION PRODUCTS REPORTED FOR THE ANTHRACENE GROUP PAHs

PAH	Degradation Products	Reference
Anthracene	2,3-dihydroxynaphthalene via trans-1,2-dihydro-1,2-dihydroxyanthracene, 1,2-dihydroxyanthracene and 2-hydroxy-3-naphthoic acid.	Evans et al. (1965)
Phenanthrene	1-hydroxy-2-naphthoic acid, salicylic acid, catechol.	Kaneko et al. (1968, 1969)
Phenanthrene	1,2-dihydroxynaphthalene via trans-3-4-dihydro-3,4-dihydroxy-phenanthrene; 3,4-dihydroxyphenanthrene; and 1-hydroxy-2-naphthoic acid.	Colla et al. (1959)

TABLE 4-18. BIODEGRADATION RATES OF ANTHRACENE GROUP PAHs

Test Type/Population Origin	Compound Tested	Results	Source
Static flask (wastewater culture)	Anthracene	92% lost at 5 mg/l and 51% at 10 mg/l at 1 week in acclimated culture.	Quave et al.(1980)
	Phenanthrene	0% lost at 5 and 10 mg/l at 1 week in non-acclimated culture	Quave et al.(1980)
	Fluorene	77% lost at 5 mg/l and 45% at 10 mg/l at 1 week in acclimated culture	Quave et al.(1980)
	Fluoranthene	100% lost at 5 mg/l and 0% at 10 mg/l at 1 week in acclimated culture	Quave et al.(1980)
	Pyrene	100% lost at 5 mg/l and 0% at 10 mg/l at 1 week in acclimated culture	Quave et al.(198)
Freshwater Aquatic	Anthracene	80% degraded over 12 weeks due to both photolysis and biodegradation	Giddings et al. (1979)
Soil population from near an oil drilling site	Anthracene	90% conversion in 90 min. (no conc.)	Giddings et al. (1979)
Sediment from oil-contaminated stream and uncontaminated stream	Anthracene	$t_{1/2}$ = 12 days for exposed population, $t_{1/2}$ = 120 days for unexposed	Giddings et al. (1979)
Freshwater populations	Anthracene	1st order rate constant of 0.055 day^{-1} for days 0 to 15 ($t_{1/2}$ = 13 days); 0.007 day^{-1} for days 20 to 64 ($t_{1/2}$ = 99 days) (tested 84 days). Not all due to biodegradation.	Giddings et al. (1979)

TABLE 4-18. BIODEGRADATION RATE OF ANTHRACENE GROUP PAHs (Continued)

Test Type/Population Origin	Compound Tested	Results	Source
$^{14}CO_2$ evolution from stream sediment populations from petroleum contaminated area	^{14}C-anthracene	^{14}C-anthracene approximately 60% of total PAH transformed at 120 hours	Schwall and Herbes (1978)
Warburg O_2 consumption, non-acclimated sludge population	Phenanthrene	22-46% of TOD degraded. Most degradable of 17 PAH compounds tested.	Malaney et al (1967)
	Anthracene	2-13% of TOD degraded.	Malaney et al (1967)
$^{14}CO_2$ evolution from sea water population from treated area	Anthracene	0.02 µg/l/day	Lee et al. (1978)
$^{14}CO_2$ evolution from contaminated stream sediment population	^{14}C-anthracene	2.5×10^{-3}/hr (rate reduction occurred at >1 µg/g)	Herbes and Schwall (1978)
Shake flasks with natural water populations	Pyrene	Negligible degradation for compound alone; with naphthalene = 36.7% remaining at 4 wks; with phenanthrene = 47.2% remaining	McKenna and Heath (1976)
Static flasks with natural water populations from contaminated and uncontaminated sites	Phenanthrene	50% to 100% degradation in 1 month over the year at different sites (80% = mean)	Sherrill and Sayler (1980)
Static flasks with natural water populations from contaminated and uncontaminated sites	Pyrene	0% to 57% degradation in 1 month over the year at different sites (15% = mean)	Sherrill and Sayler (1980)

TABLE 4-18. BIODEGRADATION RATES OF ANT CENE GROUP PAHs (Continued)

Test Type/Population Origin	Compound Tested	Results			Source
			% removed in 1 week		
		Experiment	Anth.	Fluor.	
Coastal estuary sediment populations (3 types) with and without presence of polychaete worm Capitella capitata	Anthracene Fluoranthene	Fine sand	2.0	1.9	Gardner et al. (1979)
		Fine sand & C. capitata	2.3	3.3	
		Medium sand	2.4	2.4	
		Medium sand & C. capitata	3.2	3.5	
		Marsh sediment	2.6	2.0	
		Marsh sediment & C. capitata	2.7	2.6	

TABLE 4-30, FLUORANTHENE LEVELS DETECTED IN WASTEWATER AND EFFLUENTS

Type of Sample	Concentration (µg/l)	Comment
Domestic Effluent	2.4	From runoff and atmospheric washout
Domestic Effluent	0.273	
Factory Effluent	2.2	Man-made sources
Sewage		
Industry	2.6-3.4	From natural and industrial sources (i.e., detergents, atmospheric washout)
Domestic	0.35	
Domestic (heavy rains)	16.3	

SOURCE: U.S. EPA 1980d.

Attachment 7

Bioaccumulation, Biodegradation, and

Persistance Data for:

Benzo(a)anthracene, Chrysene, Dibenz(a,h)anthracene,

Benzo(b)fluoranthene, Benzo(k)fluoranthene,

Benzo(g,h,i)perylene, Indeno (1,2,3-c,d)pyrene

Taken from:
EPA Document 440/4-85-020
October 1982
An Exposure and Risk Assessment
for Benzo(a)pyrene and Other
Polycyclic Aromatic Hydrocarbons
Volume IV

TABLE 5-20. BIOCONCENTRATION OF BENZO[a]PYRENE IN FRESHWATER AND SALTWATER SPECIES

Species	Duration	Bioconcentration Factor	Reference
	Freshwater Species		
Alga, *Oedogonlum cardiacum*	3 days	5,258[a]	Lu *et al.* (1977)
Snail, *Physa* sp.	3 days	82,231[a]	Lu *et al.* (1977)
Cladoceran, *Daphnia pulex*	3 days	134,248[a]	Lu *et al.* (1977)
Mosquito, *Culex pipiens quinquefasciatus*	3 days	11,536[a]	Lu et al. (1977)
Mosquitofish, *Gambusia affinis*	3 days	930[a]	Lu *et al.* (1977)
	Saltwater Species		
Clam, *Rangia cuneata*	24 hours	8.66	Neff *et al.* (1976a)
Clam, *Rangia cuneata*	24 hours	236	Neff *et al.* (1976b)
Eastern oyster, *Crassostrea virginica*	14 days	242	Couch *et al.* (in press)
Mudsucker *Gillichthys mirabills*	96 hours	0.048	Lee *et al.* (1972)
Tidepool sculpin, *Oligocottus maculosus*	1 hour	0.13	Lee *et al.* (1972)
Sand dab, *Citharichthys stigmacus*	1 hour	0.02	Lee *et al.* (1972)

[a]Model ecosystem concentration factor.

TABLE 5-22. BIODEGRADATION PRODUCTS REPORTED FOR THE BENZO[a]PYRENE GROUP PAHs

PAH	Degradation Products
Benzo[a]pyrene[a]	cis-9,10-dihydroxy-9,10-dihydro-benzo[a]pyrene[b]
Benz[a]anthracene[a]	cis-1,2-dihydroxyl-1,2-dihydro-benzo[a]anthracene[b]

[a] Fungi.

[b] Tentative identification.

Source: Gibson (1976).

TABLE 5-22. BIODEGRADATION PRODUCTS REPORTED FOR THE BENZO[a]PYRENE GROUP PAHs

PAH	Degradation Products
Benzo[a]pyrene[a]	cis-9,10-dihydroxy-9,10-dihydro-benzo[a]pyrene[b]
Benz[a]anthracene[a]	cis-1,2-dihydroxyl-1,2-dihydro-benzo[a]anthracene[b]

[a] Fungi.

[b] Tentative identification.

Source: Gibson (1976).

TABLE 5-19. PREDICTED HALF-LIVES FOR BENZO[a]PYRENE TRANSFORMATION AND REMOVAL PROCESSES IN GENERALIZED AQUATIC SYSTEMS

Process	Half-life (hours)			
	River	Eutrophic Pond	Eutrophic Lake	Oligotrophic Lake
Photolysis	3.0	7.5	7.5	1.5
Oxidation	>340	>340	>340	>340
Volatilization	140	350	700	700
Biodegradation	$>10^4$	$>10^4$	$>10^4$	$>10^4$
Hydrolysis	NA	NA	NA	NA

Source: Smith et al. (1978).

TABLE 5-23. BIODEGRADATION RATES OF THE BENZO[a]PYRENL GROUP PAHs: INDIVIDUAL COMPOUND STUDIES

Test Type/Population Origin	Compound Tested	Results	Reference
Static flask (wastewater population)	Benz[a]anthracene	Inconsistent degradation over month period of acclimation from 0% degraded to 41% degraded in one week at 5 mg/l	Quave et al. (1980)
Static flask (wastewater population)	Chrysene	59% lost at 5 mg/l and 38% at 10 mg/l at one week in acclimated culture	Quave et al. (1980)
Freshwater populations - enrichment shake flask, also using naphthalene in culture	Benzo[a]pyrene	No degradation observed in 6-week period	Colwell and Sayler (1978)
	Benz[a]anthracene	No degradation observed in 6-week period	Colwell and Sayler (1978)
Adapted soil populations of Pseudomonas aeruginosa and Escherischia coli	Benzo[a]pyrene	90% taken up from medium, 10-26% metabolized	Lorbacher et al. (1971)
Salmonella typhimurium, Aerobacter aerogenes, Escherischia coli, Saccharomyces cerevisiae	Benzo[a]pyrene	Species accumulate compound but little metabolized. Can take up as much as 1 to 2 x 10^{-10} µg/cell (E. coli).	Moore and Harrison (1965)
Mycobacterium flavum M. rubrum, M. lacticolum, M. smeginatis, Bacillus megaterium, Bacillus sphaericus	Benzo[a]pyrene	M. rubrum and M. flavum metabolized 50% of compound in 4 days. Other species accumulated the compound (no mention of biodegradation)	Poglazova, et al. (1966, 1976a,b)

TABLE 5-23. BIODEGRADATION RATES OF THE BENZO[a]PYRENE GROUP PAHs: INDIVIDUAL COMPOUND STUDIES (Continued)

Test Type/Population Origin	Compound Tested	Results			Reference
Coastal estuary sediment populations (3 types) with and without presence of polychaete worm, Capitella capitata	Benzo[a]pyrene Benz[a]anthracene		% removed in 1 week		Gardner et al. (1979)
		Experiment	BaP	BaA	
		Fine sand	1.2	1.5	
		Fine sand & C. capitata	2.4	2.7	
		Med. sand	1.4	1.8	
		Med. sand & C. capitata	3.0	3.0	
		Marsh sed.	0.84	1.4	
		Marsh sed. & C. capitata	1.98	1.8	
Soil bacteria from benzo-pyrene contaminated area and from non-contaminated area	Benzo[a]pyrene	Acclimated population metabolized (75-86% of compound in 5 days; non-acclimated population 48-59% in same period			Shabad (1978) Shabad (1971a) Shabad et al. (1971b)
Bacteria in power plant and coke over wastewater	Benzo[a]pyrene	Metabolized <15% of compound			Poglazova et al. (1972)
$^{14}CO_2$ evolution with sea water population from treated area	benz[a]anthracene benzo[a]pyrene	Not degraded Not degraded			Lee et al. (1978)

TABLE 5-23. BIODEGRADATION RATES OF THE BENZO[a]PYRENE GROUP PAHs: INDIVIDUAL COMPOUND STUDIES (Continued)

Test Type/Population Origin	Compound Tested	Results	Reference
CO_2^{14} evolution from contaminated stream sediment population	[C^{14}] benz[a]anthracene [C^{14}] benz[a]pyrene	10^{-4}/h No measurable transformation in 26 days	Schwall and Herbes (1978)
Shake flasks with natural water populations		Percent main compound (column 2) remaining at 4 weeks	McKenna and Heath (1976)

	+ naphthalene	+ phenanthrene
Benzo[a]pyrene	83.5	38.3
Benz[a]anthracene	58.3	33.8
Dibenz[a,h]anthracene	92.7	32.9

Negligible degradation was observed for each compound alone.

Attachment 8

Department of Health and Human Services

Memorandum

DEPARTMENT OF HEALTH & HUMAN SERVICES

Public Health Service
Agency for Toxic Substances
and Disease Registry

Memorandum

Date January 17, 1986

From Acting Director
Office of Health Assessment

Subject Health Assessment: United Creosote Site
Conroe, Texas

To Mr. Carl R. Nickam
Public Health Advisor
EPA Region VI

EXECUTIVE SUMMARY

The United Creosote Site contains residual polynuclear aromatic hydrocarbons (PAH's) and pentachlorophenol from the former wood-preserving activities on the site. These residues are primarily subsurface; however, there are isolated "tar mats" located in various residential yards. The Environmental Protection Agency (EPA), Region VI, requested an acceptable cleanup level for these residues. During an October 10, 1985 conference call with Region VI, a value of 100 ppm for total PAH in surficial residential soil was suggested as a value that is unlikely to result in a public health risk.

STATEMENT OF PROBLEM

After Region VI reviewed the July 31, 1985 Superfund Implementation Group memorandum evaluating the potential health hazard presented by the chemical contamination, they requested assistance in developing a design value for the planned cleanup of the site.

DOCUMENTS REVIEWED

1. Memorandum from Don Williams, EPA Region VI, October 10, 1985.

2. Memorandum from Georgi A. Jones, Superfund Implementation Group, July 31, 1985.

3. ATSDR United Creosote site file.

CONTAMINANTS AND PATHWAYS

The principle contaminants at this site are creosote and pentachlorophenol. The exposure pathways are direct contact with contaminated soils and creosote residues, and the consumption of contaminated groundwater. The highest levels of creosote contamination reported are located in "tar mats" at various locations near the site, both on and beneath the surface

of the soil. Except for the few reportedly isolated "tar mats," the predominate contamination at the site is subsurface. Without substantial effort on the part of the human population, this subsurface contamination presents little opportunity for contact. The local groundwater is contaminated with both pentachlorophenol and the more soluble PAH's; however, this water, reportedly, is not currently being used for domestic purposes.

DISCUSSION

In a published article[1], the Centers for Disease Control (CDC) derived an action level at which to limit human exposure for 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8,-TCDD) contaminated residential soil. This derived value was based upon extrapolations from animal toxicity experiments (including carcinogenicity and reproductive effects) to possible human health effects in order to estimate a reasonable level of risk for 2,3,7,8-TCDD. A 10^{-6} excess lifetime risk was used in the development of this TCDD soil level.

The Environmental Protection Agency's Carcinogen Assessment Group has derived a relative potency index for more than 50 chemicals[2]. The order of magnitude potency index for 2,3,7,8-TCDD is eight, while that for benzo(a)pyrene is only three. Thus, 2,3,7,8-TCDD is considered to be five orders of magnitude more potent as a carcinogen than benzo(a)pyrene. Using only this order of magnitude difference in potency between the two chemicals and the CDC-derived residential soil action level, gives 100,000 ppb of benzo(a)pyrene equivalent to 1 ppb of 2,3,7,8-TCDD in soil.

In the model used to derive the 2,3,7,8-TCDD soil value, the assumption concerning the amount of soil ingested has been shown to be high. A recent unpublished study by CDC has shown the amount of soil ingested by children of the soil-eating age ranges from 0.1 to 1 gram per day (S. Binder personal communication). Thus, the model estimate for soil ingestion during the period of minimum hygiene is excessive by at least an order of magnitude. Since the other soil ingestion rates in the model are also estimates, there is a good likelihood that they are also in error, possibly by more than an order of magnitude. Thus, the model very likely overestimates the total lifetime soil ingestion exposure by at least one order of magnitude.

In addition, the model contains a factor to account for the environmental degradation of the specific chemical. The factor for 2,3,7,8-TCDD assumed a 12-year half-life in soil. While the numerous PAH's have a range of half-life values in surface soil, which will be dependent upon the specific soil and climatological conditions encountered, even the maximum half-life for the most degradation-resistant compound is less than the value assigned for 2,3,7,8-TCDD in the model. Even with a six year half-life, a persons lifetime exposure would be substantially reduced when compared to that estimated with the longer half-life used in the TCDD risk assessment.

Thus, considering only these two areas for modifications to the soil exposure model used to develop the 2,3,7,8,-TCDD risk assessment, it can be seen that a residue of 100 ppm of PAH's in soil is not likely to present a significant human health hazard.

In addition, when considering the significance of contamination at the site, the facts that all PAH's are neither carcinogenic nor (for those suspected carcinogens) as potent as benzo(a)pyrene must be a part of the evaluation. As a first approximation of a site, it may be valid to use the total PAH concentration to determine an estimate of the significance of the contamination. However, when determining cleanup action, the use of isomers and compounds, which are truly hazardous, would be most appropriate when that information is available.

The application of the model to obtain the 100 ppm cleanup concentration has assumed that all PAH's are as potent as benzo(a)pyrene, generally considered to be the most potent carcinogen of the PAH's. This is, in fact, not valid, as those PAH compounds which are considered to be suspected or probable carcinogens, comprise less than half of the total PAH concentration at any site. In addition, many of these compounds designated as suspected or probable carcinogens, are much less potent than benzo(a)pyrene[3].

The Environmental Protection Agency recently released a Draft Health Advisories[4] for pentachlorophenol in drinking water. The life-time value for adults in this document is 1050 ug/l. This value is substantially greater than the 21 ug/l discussed for use in evaluating the groundwater contamination at this site. Based upon this new evaluation for pentachlorophenol in drinking water, the need for and extent of groundwater renovation for this site should be reconsidered.

RECOMMENDATIONS

Polynuclear Aromatic Hydrocarbon (PAH's) concentrations in residential soil less than 100 ppm should present no significant acute or chronic health threat to human health through any normal route of exposure.

The need for and extent of groundwater renovation should be reconsidered based upon the recent EPA Health Advisory for pentachlorophenol.

We hope this information is useful to you.

(for) Stephen Margolis, Ph.D.

REFERENCES

1. Kimbrough, R.D., Falk, H., Stehr, P., and Fries, G., "Health Implications of 2,3,7,8-tetrachlorodibenzodioxin (TCDD) Contamination of Residential Soil," J. Tox. & Envir. Health, 14 47-93, 1984.

2. EPA, "Health Assessment Document for Epichlorohydrin, Final Report," EPA-600/8-83-032F, pp. 7-62, 1984.

3. "Evaluation of the Carcinogenic Risk of Chemicals to Humans, Polynuclear Aromatic Compounds, Part 1, Chemical, Environmental and Experimental Data," IRAC Monographs, Volume 32, International Agency for Research on Cancer, IRAC, Lyon, France, 1983.

4. EPA, Office of Drinking Water, Criteria and Standards Division, Draft Health Advisory, September 1985.

Attachment 9

Sample Preparation Method and Equipment

for H_2S Analysis

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

JUL 18 [redacted]

OFFICE OF
SOLID WASTE AND EMERGENCY RESPONSE

MEMORANDUM

SUBJECT: Interim Thresholds for Toxic Gas Generation Reactivity (§261.23(a)(5))

FROM: Eileen Claussen, Director
Characterization & Assessment Division (WH-562B)

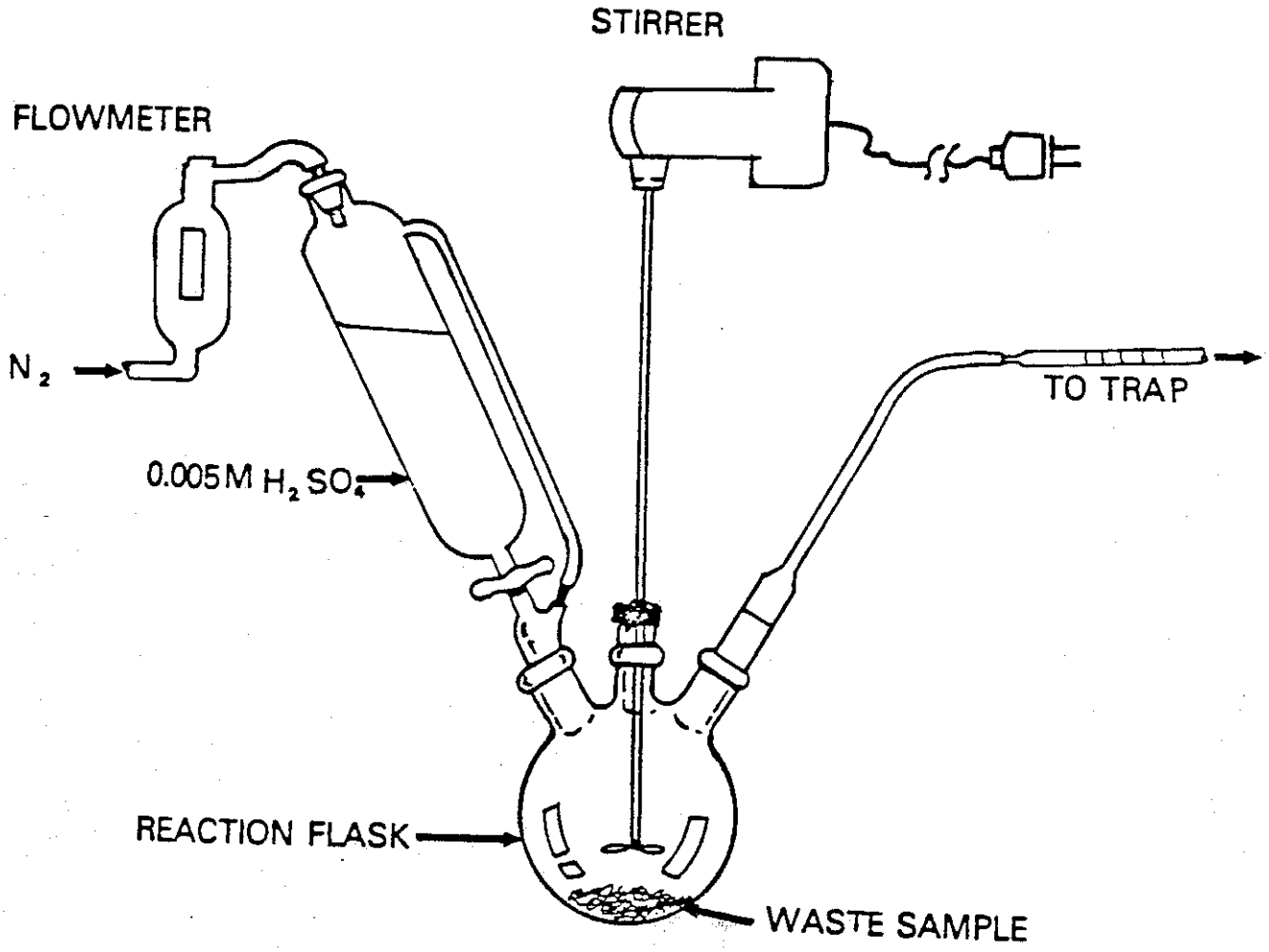
TO: Solid Waste Branch Chiefs, Regions I to X

Over the past year, we have received many inquiries about how to evaluate wastes for reactivity (§261.23(a)(5)). We have initiated a number of studies in this area, and expect to propose a quantitative threshold for toxic gas generation reactivity in December of this year. On an interim basis, however, we feel strongly that wastes releasing more than the following levels of toxic gas should be regulated as hazardous wastes:

Total Available Cyanide: 250 mg HCN/Kg waste
Total Available Sulfide: 500 mg H_2S/Kg waste

The available cyanide or sulfide should be measured using the attached draft testing methods. Work currently being done on the agitation and waste introduction steps may result in significant changes in the subsequent proposed test. However, pending the conclusion of the investigations, we recommend use of this draft procedure.

I have attached a brief outline of the methodology we have employed to derive these interim thresholds. Work on estimating dispersion factors, however, is currently in progress. Any comments or suggestions you may have with respect to either the draft test method or the approach to establishing thresholds would be appreciated.


STIRRER
FLOWMETER
N_2
TO TRAP
0.005M H_2SO_4
REACTION FLASK
WASTE SAMPLE

TEST METHOD TO DETERMINE HYDROGEN SULFIDE RELEASED FROM WASTES

1. Scope and Application

   1.1 This method is applicable to all wastes with the conditions that waste which are combined with acids do not form explosive mixtures.

   1.2 This method provides a way to determine the specific rate of release of hydrogen sulfide upon contact with an aqueous acid.

   1.3 This procedure releases only the evolved hydrogen sulfide at the test conditions. It is not intended to measure forms of sulfide other then those that are evolvable under the test conditions.

2. Summary of Method

   2.1 An aliquot of the waste is acidified to pH 2 in a closed system. The gas generated is swept into a scrubber. The analyte is quantified. The procedure for quantifying the sulfide is given in Method 376.1.

3. Sample Handling and Preservation

   3.1 Samples containing, or suspected of containing sulfide wastes, should be collected with a minimum of aeration. The sample bottle should be filled completely, excluding all head space, and stoppered. Analysis should commence as soon as possible; and samples should be kept in a cool, dark place until analysis begins.

   3.2 It is suggested that samples of sulfide wastes be tested as quickly as possible. Although they can be preserved by adjusting the sample pH to 12 with strong base and addition of zinc acetate to the sample, this will cause dilution of the sample, increase the ionic strength and, possibly, change other physical or chemical characteristics of the waste which may affect the rate of release of the hydrogen sulfide. Storage of samples should be under refrigeration and in the dark.

   3.3 Testing should be in a ventilated hood.

4. Apparatus (See Figure 1)

   4.1 Three-neck, round-bottom flask with 24/40 ground-glass joints, 500 ml.

   4.2 Stirring apparatus to achieve approximate 30 rpm. This may be a rotating magnet and stirring bar combination or an overhead motor driven propellor stirrer.

   4.3 Separatory funnel with pressure equalizing tube and 24/40 ground glass joint and teflon sleeve.

4.4 Flexible tubing for connection from nitrogen supply to apparatus.

4.5 Water pumped or oil pumped nitrogen gas with two stage regulator.

4.6 Rotometer for monitoring nitrogen gas flow rate.

4.7 Industrial hygiene type detector tube for sulfide (100 - 2000 ppm range).

Reagents

5.1 Sulfuric Acid 0.005 M

5.2 Sulfide reference solution: Dissolve 4.02 gm of $Na_2S \cdot 9H_2O$ in a 1.0 liters of distilled water. This is 680 ppm hydrogen sulfide. Dilute this stock solution to cover the analytical range required (100 ppm to 680 ppm).

5.3 NaOH solution, 1.25N: dissolve 50 gm NaOH in distilled water and dilute to 1 liter with distilled water.

5.4 NaOH solution, 0.25 N: Dilute 200 ml of sodium hydroxide solution to 1 liter with distilled water.

System Check

6.1 The operation of the system can be checked using the sulfide reference solution. The reference solution can be used to verify system operation.

Procedure

The procedure is dependent on the method chosen for quantification.

-If an adsorbent tube indicator is used for quantification, the analyst should start the procedure with Step 7.2.0

-If another procedure is chosen, the analyst should start the procedure with Step 7.1.0

7.1.0 Procedure employing scrubber solution with wet method quantification.

7.1.1 Add 500 ml of 0.25N NaOH solution to a calibrated scrubber and dilute with distilled water to obtain an adequate depth of liquid.

7.1.2 Assemble the system and adjust the flow rate of nitrogen using the rotometer. Flow should be 60 ml/min.

7.1.3 Add 10 gm of the waste to be tested to the system.

7.1.4 With the nitrogen flowing, add enough acid to fill the system 1/2 full, while starting the 30 minute test period.

7.1.5 Begin stirring while the acid is entering the round bottomed flask.

7.1.6 After 30 minutes close off the nitrogen and disconnect the scrubber. Determine the amount of sufide in the scrubber by Method 376.1 (enclosed). following methods

7.1.7 Go to Section 8.1 for calculation of specific rate of release.

7.2.0 Procedure employing dry adsorbent indicator tube for quantification.

7.2.1 Assemble the system with the adsorber tube in place, making sure that the tube has the proper orientation (see manufacturer's literature).

7.2.2 Adjust the flow rate of nitrogen to be 60 ml/min using the rotometer.

7.2.3 Add 10 gm of waste to the system.

7.2.4 Start the test by adding enough acid of pH 2 to fill the round bottom flask half full.

7.2.5 After 30 minutes, read the length of the stain on the indicator tube. Follow the manufacturer's directions in determining the concentration of sulfide in the gas using the length of the stain and the amount of gas passed through the tube.

7.2.6 Go to Section 8.2 to calculate the specific rate of release.

8 Calcuations

8.1 Determine the specific rate of release of H_2S.

-Concentration of H_2S in scrubber (mg/l) = A
This is obtained from method 376.1 or 376.2.

-Volume of solution in scrubber (l) = L

-Weight of waste used (Kg) = W

-Time of experiment = Time N_2 stopped - Time N_2 started (seconds) = S

$$R = \text{spec. rate of release} = \frac{A \cdot L}{W \cdot S}$$

Total available H_2S = $R \cdot 1800$ mg/Kg

2 Calculations for adsorber tube determination of sulfide

Final detector tube reading (ul)	=	L
Flow rate N_2 through tube (ml/min)	=	V
Time of flow (min)	=	T
Conversion factor = 1.17	=	D
Weight of sample (kg)	=	W
Specific rate of release	=	R

$$R = \frac{L}{1000 \cdot W} \cdot (1.42) = \text{mg/Kg of } H_2S$$